

WHAT IS CLAIMED IS:

1. A bioreactor, particularly for bioartificial organs, comprising a closed and substantially tubular body inside which there is a containment cavity; an animal and/or human cell culture and support structure,  
5 accommodated in said cavity and suitable to be crossed by a fluid to be processed; a port for the inflow of said fluid to be processed, which is formed in said body upstream of said structure; a port for the outflow of the processed fluid, which is formed in said body downstream of said structure; a first chamber for collecting the fluid to be processed, which is formed in  
10 said cavity upstream of said structure and is connected to the outside of said body by means of said inflow port; and a second chamber for collecting the processed fluid, which is formed in said cavity downstream of said structure and is connected to the outside of said body by means of said outflow port; comprising a first bundle of hollow capillary fibers for the inflow of said  
15 fluid to be processed, which is accommodated in said cavity and interposed between said first collection chamber and said structure, and a second bundle of hollow capillary fibers for the outflow of said processed fluid, which is accommodated in said cavity and is interposed between said structure and said second collection chamber.

20 2. The bioreactor according to claim 1, comprising first anchoring means and second anchoring means for said first bundle and said second bundle of fibers respectively.

3. The bioreactor according to claim 2, wherein said body comprises two opposite ends closed hermetically by respective covers, said inflow port  
25 being formed in one of said covers, said outflow port being formed in the other one of said covers.

4. The bioreactor according to claim 1, comprising at least one inlet for the inoculation of said cells, which is formed in said body between said first bundle and said second bundle of fibers.

30 5. The bioreactor according to claim 4, comprising at least one outlet

for the evacuation of the inoculated cells that have not adhered to said structure formed in said body between said first bundle and said second bundle of fibers.

6. The bioreactor according to claim 5, comprising a chamber for the inflow of the inoculated cells that is formed in said cavity, between said structure and one of said first and second bundles of fibers, and is connected to the outside of said body through said inoculation inlet.

7. The bioreactor according to claim 6, comprising a chamber for the outflow of the cells that have been inoculated and have not adhered, said chamber being formed in said cavity, between said structure and one of said first and second bundles of fibers, and being connected to the outside of said body through said evacuation outlet.

8. The bioreactor according to claim 7, wherein said inflow chamber and said outflow chamber are formed respectively between said second bundle of fibers and said structure and between said structure and said first bundle of fibers.

9. The bioreactor according to claim 5, comprising plugs for closing said inoculation inlet and said evacuation outlet.

10. The bioreactor according to claim 1, wherein said structure comprises a panel that is wound on itself in a roll or spiral with an axis that is substantially parallel to the longitudinal axis of said body, the longitudinal edge of said panel arranged inside said roll or spiral being free, the opposite longitudinal end being free and in contact with the inside wall of said cavity.

11. The bioreactor according to claim 10, wherein said panel is wound around said internal longitudinal edge through an arc of at least 270°.

12. The bioreactor according to claim 10, wherein said panel comprises at least two mutually superimposed and parallel plate-like layers, a first layer comprising a matrix for supporting said cells, a second layer

comprising a matrix for diffusing and distributing the inoculated cells.

13. The bioreactor according to claim 12, wherein said panel comprises a third layer that is identical to said first layer and is superimposed on said second layer and parallel thereto.

5 14. The bioreactor according to claim 13, wherein said first layer and/or said third layer are permeable with respect to said fluid.

15. The bioreactor according to claim 13, wherein said first layer and/or said third layer are constituted by sheets of polymeric fabric having a crossed weave with a random or ordered arrangement.

10 16. The bioreactor according to claim 15, wherein said polymeric fabric of said first layer and/or of said third layer is made of polyester or the like.

17. The bioreactor according to claim 15, wherein the total volume of said first layer and/or said third layer is comprised between 5 and 15% of  
15 the total volume available for said cells.

18. The bioreactor according to claim 12, wherein said second layer has a lattice-like structure.

19. The bioreactor according to claim 1, wherein said first bundle of fibers comprises at least one flat order of hollow capillary fibers that are  
20 arranged substantially parallel to the longitudinal axis of said body and are individually bent in a U-shape, with their respective open ends directed toward said first collection chamber, said fibers being permeable to said fluid.

20. The bioreactor according to claim 1, wherein said first bundle of  
25 fibers comprises at least two flat and superimposed orders of hollow capillary fibers that are permeable to said fluid and are individually bent in a U-shape, with their respective open ends directed toward said first collection chamber, the fibers of one of said two orders being arranged at an angle, with respect to the fibers of the other order, that is variable between  
30 15° and 30°.

21. The bioreactor according to claim 1, wherein said second bundle of fibers comprises at least one flat order of hollow capillary fibers that are arranged substantially parallel to the longitudinal axis of said body and are individually folded in a U-shape, their respective open ends being directed  
5 toward said second collection chamber, said fibers being permeable to said fluid.

22. The bioreactor according to claim 1, wherein said second bundle of fibers comprises at least two flat and superimposed orders of hollow capillary fibers that are permeable to said fluid and are individually bent in a  
10 U-shape, their respective open ends being directed toward said second collection chamber, the fibers of one of said two orders being arranged, with respect to the fibers of the other order, at an angle that can vary between 15° and 30°.

23. The bioreactor according to claim 1, wherein each one of said  
15 fibers of said first bundle and of said second bundle is constituted by a segment of a capillary tube made of microporous material which is bent in a U-shape substantially at the centerline so as to form two straight branches which are mutually substantially parallel and have open ends that lead respectively into said first collection chamber and into said second  
20 collection chamber.

24. The bioreactor according to claim 23, wherein said microporous material has pores with an average diameter comprised between 0.10  $\mu\text{m}$  and 0.50  $\mu\text{m}$ .

25. The bioreactor according to claim 23, wherein said microporous  
25 material is constituted by polyether sulfone or the like.

26. The bioreactor according to claim 1, wherein the distribution density and the diameter of said fibers are constant throughout the extension of said first bundle and/or said second bundle.

27. The bioreactor according to claim 2, wherein said first anchoring  
30 means and said second anchoring means comprise at least one layer of

sealing material that is accommodated snugly in said cavity, is arranged substantially at right angles to the longitudinal axis of said body, and in which the fibers of said first bundle and of said second bundle respectively are embedded at least partially.

5        28. The bioreactor according to claim 27, wherein said sealing material is of the polymeric type based on polyurethane or the like.

29. The bioreactor according to claim 3, wherein said first collection chamber and said second collection chamber are formed respectively between said covers and said first and second anchoring means.

10        30. The bioreactor according to claim 4, wherein the direction of the flow of said inoculated cells from said inoculation inlet through said structure has a component that is substantially perpendicular and a component that is substantially parallel to the longitudinal axis of said body.

15        31. The bioreactor according to claim 1, wherein the direction of the flow of said fluid from said inflow port to said outflow port through said structure is substantially parallel to the longitudinal axis of said body.

32. The bioreactor according to claim 1, wherein said fluid is plasma or ultrafiltrate.